

## **Redescription and Multivariate Analysis of Genus *Phintella* (Araneae, Salticidae) from Korea**

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### **ABSTRACT**

Descriptions and identifications of 6 species belonging to genus *Phintella* from Korea are in insufficient and inaccurate situation. In the present paper, redescrptions, illustrations and identification key are provided for 7 species of genus *Phintella* including *P. popovi* newly recorded in Korean spider fauna, and *Icius munitus* described by Wesolowska (1981a) was synonymized to *P. cavaleriei*. For the author's identification and pairing to be valid, multivariate analysis was performed with 13 RVCs below STD 0.05 to 134 individuals. The result of discriminant analysis carried out with 13 RVCs of 134 individuals was not satisfactory, but cluster analysis performed with mean ratio values of 14 OTUs to 13 RVCs showed the same result with author's pairing except *P. abnormis*, which has larger dissimilarity than the pairs of the others. So pairing of 7 species was possible as a whole because one species only failed in pairing, even though this is imperfect result. This method seems to be helpful to pairing test and identification if it were to improve.

Key words: Salticidae, *Phintella*, cluster analysis, pairing, Korea

### **INTRODUCTION**

The species of genus *Phintella* are often apt to be misidentified and mispaired because their important characteristics such as male palp, female epigynum and body patterns are very similar, and especially highly variable in the body patterns. In Korean Peninsula, 6 species, *P. abnormis*, *P. bifurcilinea*, *P. linea*, *P. melloteei*, *P. parva* and *P. versicolor*, have been reported in genus

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*Phintella*, but their descriptions are all that Paik (1962 and 1970) and Wesolowska (1981a) have partially done on the female or male except *P. linea*, and Wesolowska described *P. abnormis* as *P. sp.*, male of *P. melloteei* as one of *P. linea*, and female of *P. popovi* as one of *P. linea*. *Icius munitus* described by Wesolowska (1981a), which was synonymized to *P. versicolor* by Platnick (1989) later, is considered to be a synonym of *P. cavaleriei* described by Schenkel (1963).

In order to clarify the classification of genus *Phintella* from Korea, the author redescribed 6 species, described 1 species as new to Korean spider fauna and showed an identification key of this genus. For author's identification and pairing to be valid, ratio values of 13 quantitative characters were measured (Table 2), both sexes of 7 species were grouped as 14 Operational Taxonomic Units (OTUs), and multivariate analyses such as cluster and discriminant analyses were carried out.

## MATERIALS AND METHODS

The author identified 134 individuals of spiders of the genus *Phintella* from Korea, collected during the period from 1956 to 1994, and made illustrations, redescrptions and an identification key for 7 species. All measurements were taken with an ocular micrometer under a binocular dissecting microscope and listed in mm. Mean and STD are given at table 1.

SPSS/PC+ (ver. 3.0) program was used in multivariate analysis. The characters used in the analysis were selected through the three steps. First, considering individual variations, 32 RVCs to ER1 were calculated from 134 specimens. Second, STDs of 32 RVCs for 134 individuals were calculated to carry out pairing excluding the conspicuous sexual dimorphisms (Table 1). Finally, through the preliminary test performed accumulatively from RVC with the least STD to one with the maximum STD, 13 RVCs below STD 0.05 to 134 individuals showing the best result were selected for the use of the analysis (Table 2). Cluster analysis was performed with mean ratio values of 14 OTUs for 13 RVCs. Distance measure was computed by the squared Euclidian distance commonly used, and Ward method, one of those exhibited the best results, was chosen as a method of combining clusters. Discriminant analysis was computed by canonical discriminant functions, and performed with 13 RVCs of 134 individuals, but group centroids were only presented. Selection of variables has been done by the method minimizing Wilk's lambda.

The abbreviations used in this paper as follows, and the small letters of abbreviations indicate ratio value of each character to ER1: CAL, carapace length (from the front of anterior median eye to the posterior end of carapace); CAW, carapace width; ER, length of eye row; FE, femur length; P, patella length; T, tibia length; M, metatarsus length; TA, tarsus length; F1D, width of first femur; A, position of ER2 (from the front of anterior median eye to the center of posterior median eye); B, height of ocular quadrangle (from the front of anterior median eye to the posterior end of posterior lateral eye); C, diameter of anterior median eye; D, diameter of anterior lateral eye; E, diameter of posterior median eye; F, diameter of posterior lateral eye; G, interval of posterior lateral eyes; STD, standard deviation; RVC, ratio value of character.

## RESULTS

### Description

#### Genus *Phintella* Strand in Boesenberg and Strand, 1906

*Phintella* Strand in Boesenberg and Strand, 1906, p. 333, Type species: *P. bifurcilinea* (Boesenberg and Strand, 1906).

**Diagnosis.** Body color generally yellowish brown. Ocular quadrangle height longer than the first eye row. First eye row equal or longer than third one. Second eye row set back from front more than a half of the ocular quadrangle height. Abdomen frequently with intermittent black stripes obliquely and longitudinally. Palpal organ of male simple, with single tibial apophysis. Epigynum of female with a pair of spermathecae and canals.

#### Key to species of *Phintella*

1. Dorsal abdomen with an anterior median groove ..... *P. bifurcilinea*  
Dorsal abdomen without an anterior median groove ..... 2
2. Distal part of dorsal abdomen with a round black spot. .... *P. cavaleriei*  
Distal part of dorsal abdomen with a longish black stripe ..... 3
3. Dorsum of abdomen with two longitudinal black stripes, one on either side of the mid-line, running its full length ..... 4  
Dorsum of abdomen with two longitudinal black stripes interrupted by black chevrons, one on either side of the mid-line ..... 5
4. Dorsal abdomen posteriorly with two to three interrupted chevrons ..... *P. abnormis*  
Dorsal abdomen posteriorly with four to five intact chevrons ..... *P. parva*
5. The first chevron on dorsal abdomen behind second pair of sigilla ..... *P. popovi*  
The first chevron on dorsal abdomen in front of second pair of sigilla. .... 6
6. Carapace with a distinct concave black marking posteriorly ..... *P. linea*  
Carapace without a marking, or with a pair of faint markings posteriorly ..... *P. melloteei*

#### *Phintella abnormis* (Boesenberg and Strand, 1906) (Figs. 1-8)

*Jotus abnormis* Boesenberg and Strand, 1906, p. 336, pl.14, fig. 377.

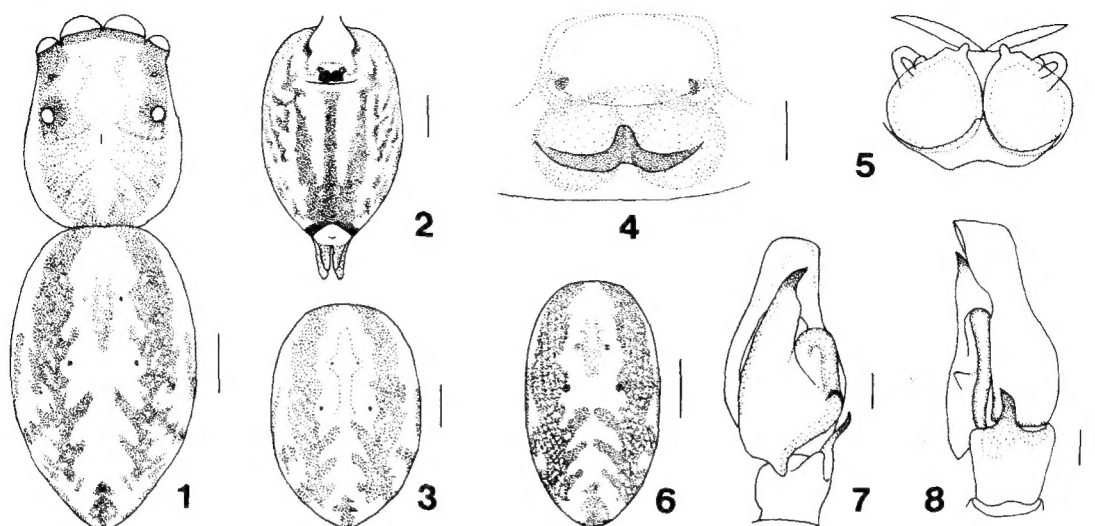
*Icius abnormis*: Prószyński, 1979, p. 310, fig. 130.

*Icius* sp.: Wesolowska, 1981a, p. 60, figs. 49-51.

*Phintella abnormis*: Prószyński, 1983b, p. 6, figs. 15-16; Bohdanowicz and Prószyński, 1987, p. 100, figs. 172-179.

**Specimens examined.** 3 ♂♂, Cheju-do Ch'önjeyön, 26 Jun. 1964, K.Y. Paik; 2 ♀♀, Kyöngsangbuk-do, Ch'öngsong, Top'yöng, 18 Jul. 1966, J.H. Kim; 5 ♀♀, Taegu, ? Aug. 1966, K.Y. Paik; 1 ♂, Kyöngsangbuk-do, Kümünng, Hwangaksan, 23 Jun. 1968, K.Y. Paik; 3 ♀♀, Kyöngsangbuk-do, Yöngil, Naeyönsan, 15 Oct. 1977, B.K. Seo; 1 ♀, 5 ♂♂, Kyöngsangbuk-do, P'algonsan, Ünhaesa, 19 Jun. 1992, S.Y. Lee.

**Description.** Carapace whitish brown with a pale black longitudinal marking on each side. Leg



**Figs. 1-8.** *Phintella abnormis*: 1, female, dorsal view; 2, female abdomen, ventral view; 3, another female abdomen, dorsal view; 4, epigynum of female; 5, internal genitalia of female; 6, male abdomen, dorsal view; 7, male papal organ, ventral view; 8, ditto, retrolateral view. Scale lines: 0.5 mm (figs. 1-3, 6), 0.1 mm (figs. 4-5, 7-8).

formula 4312 in female, 1432 in male. Dorsum of abdomen yellowish brown with two black longitudinal stripes, one on either side. Stripes continuous from the anterior to the posterior of abdomen, and with two to three interrupted chevrons posteriorly. The end of the dorsum with a longish black stripe. Venter of abdomen with three longitudinal black stripes from epigastric furrow to the distal part where they fused.

**Distribution.** Korea, Japan, USSR.

***Phintella bifurcilinea* (Boesenberg and Strand, 1906) (Figs. 9-15)**

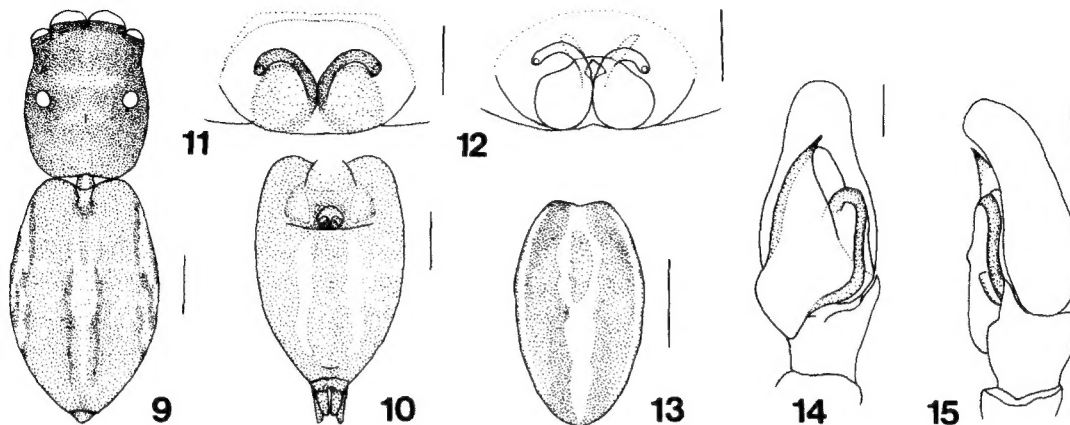
*Telamonia bifurcilinea* Boesenberg and Strand, 1906, p. 331, pl.9, fig 153, pl.13, fig. 357; Paik, 1970, p. 88, figs. 10-14.

*Phintella typica* Strand in Boesenberg and Strand, 1906, p. 333.

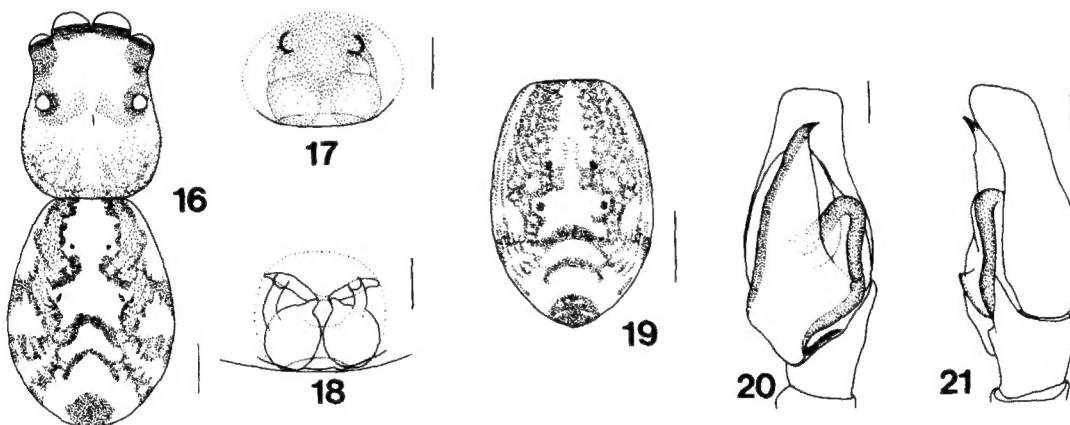
*Phintella bifurcilinea*: Prószyński, 1983b, p. 7, figs. 1-11; Bohdanowicz and Prószyński, 1987, p. 103, figs. 184-192.

**Specimens examined.** 5 ♀♀, 1 ♂, Kyöngsangnam-do, Köje, Kabae, 24 Jul. 1964, K. Y. Paik; 1 ♀, Kyöngsangnam-do, Milyang, P'yoch'ungsa, 28 Jul. 1964, K. Y. Paik; 2 ♀♀, 2 ♂♂, 1 ♀, Pusan, Kümjöngsan, 7 Jul., 5 Aug. 1974, 6 Jun. 1975, J. H. Kim; 1 ♂, Kyöngsangbuk-do, Pisülsan, 24 Jul. 1978, J. G. Choi; 1 ♀, Kyöngsangnam-do, Chinju, 13 Aug. 1981, B. K. Seo; 1 ♀, 1 ♂, Kyöngsangbuk-do, Kumi, Kūmosan, 27 Jun. 1992, S. G. Kim; 1 ♀, 1 ♂, Kyöngsangbuk-do, Talsöng, Yongyönsa, 20 Jun. 1994, S. Y. Jeong; 1 ♂, Kyöngsangbuk-do, P'algongsan, Ünhaesa, 19 Aug. 1994, M. W. Kim.

**Description.** Carapace dark brown with a yellowish brown transverse band between second and third eye row, and an arched white hair patch behind third eye row. Leg formula 4312 in female, 4132 in male. Dorsum of abdomen dark brown with an anterior median groove, and a median and



**Figs. 9-15.** *Phintella bifurcilinea*: 9, female, dorsal view; 10, female abdomen, ventral view; 11, epigynum of female; 12, internal genitalia of female; 13, male abdomen, dorsal view; 14, male papal organ, ventral view; 15, ditto, retrolateral view. Scale lines: 0.5 mm (figs. 9-10, 13), 0.1 mm (figs. 11-12, 14-15).



**Figs. 16-21.** *Phintella cavaleriei*: 16, female, dorsal view; 17, epigynum of female; 18, internal genitalia of female; 19, male abdomen, dorsal view; 20, male papal organ, ventral view; 21, ditto, retrolateral view. Scale lines: 0.5 mm (figs. 16, 19), 0.1 mm (figs. 17-18, 20-21).

two lateral longitudinal yellowish brown stripes; median stripe sometimes with a dark brown patch anteriorly. Venter of abdomen dark brown with two longitudinal yellowish brown stripes from epigastric furrow to nearly spinnerets.

**Distribution.** Korea, China, Japan, Vietnam.

***Phintella cavaleriei* (Schenkel, 1963) (Figs. 16-21)**

*Dexippus cavaleriei* Schenkel, 1963, p. 454, figs. 258a-e.

*Icius munitus*: Wesolowska, 1981a, p. 59, figs. 34-36.

*Icius cavaleriei*: Wesolowska, 1981b, p. 134, figs. 18-21.

*Phintella cavaleriei*: Prószyński, 1983b, p. 6.

**Specimens examined.** 9♀♀, 3♂♂, Kyöngsangbuk-do, P'algongsan, Ŭnhaesa, 19 Jun. 1992, S. Y. Lee; 4♀♀, 4♂♂, Kyöngsangbuk-do, Kumi, Kūmosan, 27 Jun. 1992, S. G. Kim; 1♀, Kyöngsangbuk-do, Kumi, Kūmosan, 29 May 1994, M. W. Kim; 1♀, Ch'ungch'öngbuk-do, Sobaeksan, 5 Jun. 1994, H. C. Kim.

**Description.** Carapace yellowish brown with indistinct radial black markings posteriorly. Leg formula 4312 in female, 4132 in male. Dorsum of abdomen yellowish brown with two longitudinal black stripes, one on either side, continuing from the anterior to the first intact chevron; an interrupted chevron between first and second pair of sigilla, and two intact chevrons behind second pair of sigilla; two transverse and one oblique black stripes running from each longitudinal stripe to the margin. Distal part of abdomen has a distinguishing round black spot. Venter of abdomen yellowish brown with a transverse black line on each side in front of spinnerets.

**Distribution.** Korea, China.

***Phintella linea* (Karsch, 1879) (Figs. 22-27)**

*Euophrys linea* Karsch, 1879, p. 90.

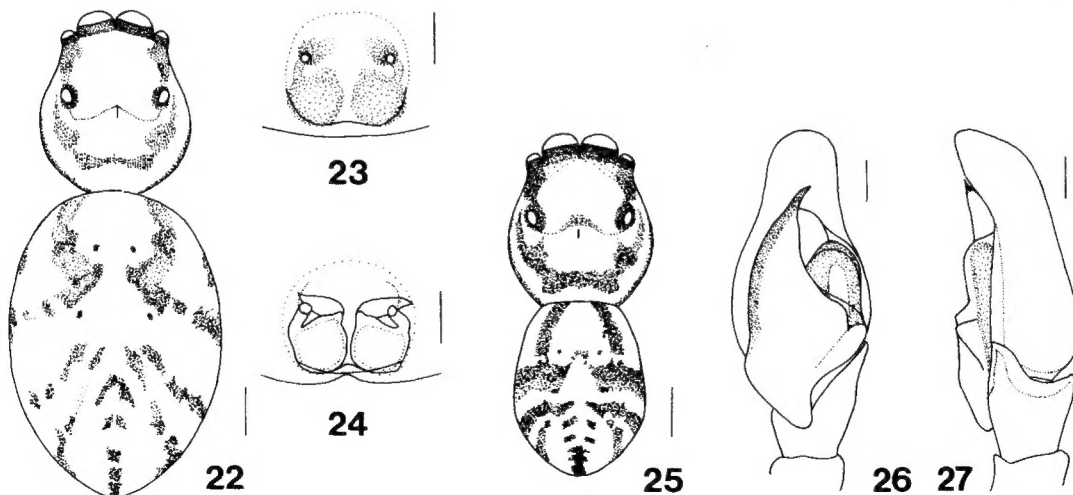
*Jotus lineus*: Boesenberg and Strand, 1906, p. 334, pl.19, fig.375.

*Icius lineus*: Prószyński, 1973, p. 113, figs. 39-43.

*Phintella linea*: Prószyński, 1983b, p. 6, figs. 12-13; Bohdanowicz and Prószyński, 1987, p. 107, figs. 193-201.

**Specimens examined.** 1♂, Kyöngsangbuk-do, Kūmrūng, Hwangaksan, 22 Jun. 1968, K. Y. Paik; 1♂, Kyöngsangbuk-do, Talsöng, Yongyönsa, 5 Aug. 1973, Y. S. Hong; 9♀♀, Kyöngsangbuk-do, Talsöng, Yongyönsa, 20 Jun. 1994, H. C. Kim; 2♀♀, 2♂♂, Kyöngsangbuk-do, Pisälsan, 7 Aug. 1978, J. H. Park; 1♂, Kyöngsangnam-do, Chinju, 14 Jul. 1981, B. K. Seo.

**Description.** Carapace yellowish brown with a distinct concave black marking posteriorly. Frequently its ground color of male dark brown, and a white hair patch on each side of eye field and



**Figs. 22-27.** *Phintella linea*: 22, female, dorsal view; 23, epigynum of female; 24, internal genitalia of female; 25, male, dorsal view; 26, male papal organ, ventral view; 27, ditto, retrolateral view. Scale lines: 0.5 mm (figs. 22, 25), 0.1 mm (figs. 23-24, 26-27).

head, behind the fovea and third eyes, each side and end of thorax. leg formula 4312 in female, 1432 in male. Dorsum of abdomen yellowish brown with two longitudinal black stripes, one on either side, continuing from the anterior to first chevron; three interrupted large chevrons, two small ones posteriorly and a longish black stripe at the end. Occasionally dorsal abdomen of male with a white hair transverse band between first and second chevron. Venter of abdomen yellowish brown with a black median stripe running its full length and a transverse black line in front of spinnerets.

**Distribution.** Korea, China, Japan.

***Phintella melloteei* (Simon, 1888) (Figs. 28-33)**

*Maevia melloteei* Simon, 1888, p. 248.

*Telamonia melloteei*: Simon, 1901, p. 540.

*Jotus difficilis* Boesenberg and Strand, 1906, p. 336; Paik, 1962, p. 77, fig. 9.

*Sitticus pallicolor* Boesenberg and Strand, 1906, p. 341, fig. 152.

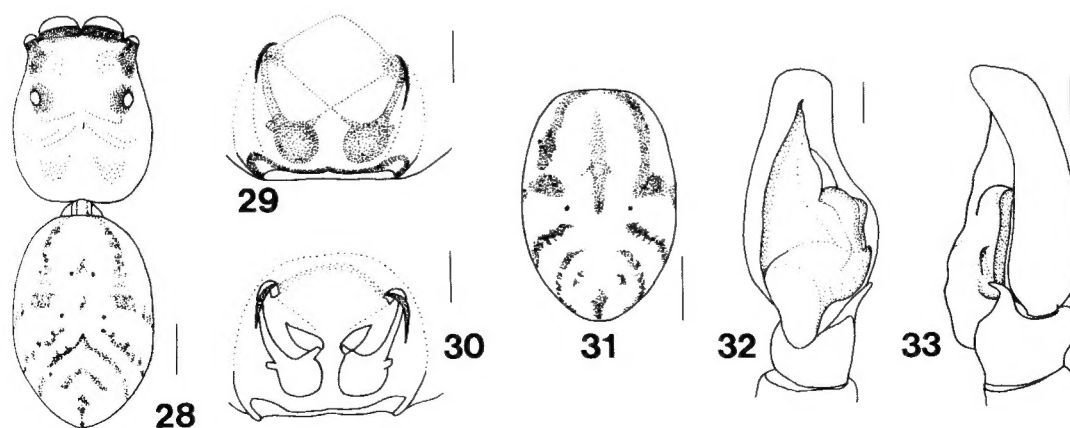
*Icius difficilis*: Prószyński, 1979, p. 331, figs. 143-149; Wesolowska, 1981a, p. 57.

*Icius linea*: Wesolowska, 1981a, p. 57, figs. 42-44 (part: ♂).

*Phintella melloteei*: Prószyński, 1983b, p. 6, fig. 14; Bohdanowicz and Prószyński, 1987, p. 110, figs. 202-209.

**Specimens examined.** 3 ♂♂, Kyongsangbuk-do, Ch'ongsong, 18 Jul. 1966, J. H. Kim; 1 ♂, Pusan, Kūmjongsan, 1 Jun. 1975, J. H. Kim; 1 ♀, Kyongsangbuk-do, P'algongsan, Ŭnhaesa, 19 Jun. 1992, S. Y. Lee; 1 ♀, Kyongsangbuk-do, P'algongsan, Ŭnhaesa, 19 Aug. 1994, S. J. Jeong; 3 ♀♀, 1 ♂ and 4 ♀♀, 2 ♂♂, Kyongsangbuk-do, Kumi, Kūmosan, 25, 27 Jun. 1992, S. G. Kim; 1 ♀, Kyongsangbuk-do, Kumi, Kūmosan, 28 Aug. 1994, J. J. Gwak; 1 ♂, Kyongsangbuk-do, Ch'ongdo, Kakbuk, 26 May 1994, S. J. Jeong; 1 ♀, Kyongsangbuk-do, P'algongsan, Pukjijangsa, 6 Aug. 1994, H. C. Kim; 1 ♀, Kyongsangbuk-do, Gasan, 27 Aug. 1993, J. H. Choi; 1 ♂, Kangwon-do, Ch'iaksan, 4 Jun. 1994, M. W. Kim; 1 ♂, Ch'ungch'ongbuk-do, Sobaeksan, 5 Jun. 1994, H. C. Kim.

**Description.** Carapace yellowish brown without a marking, or with a pair of faint markings posteriorly. Leg formula 4312 in female, 4132 in male. Dorsum of abdomen yellowish brown with



**Figs. 28-33.** *Phintella melloteei*: 28, female, dorsal view; 29, epigynum of female; 30, internal genitalia of female; 31, male abdomen, dorsal view; 32, male papal organ, ventral view; 33, ditto, retrolateral view. Scale lines: 0.5 mm (figs. 28, 31). 0.1 mm (figs. 29-30, 32-33).

two longitudinal black stripes, one on either side, continuing from the anterior to first chevron; three large and a small chevron, the first two interrupted and the last two intact or interrupted; distal part with a longish black stripe. Venter of abdomen yellowish brown with a transverse black line on each side in front of spinnerets.

**Distribution.** Korea, China, Japan, USSR.

***Phintella parva* (Wesolowska, 1981) (Figs. 34-39)**

*Icius parvus* Wesolowska, 1981a, p. 60, figs. 45-48.

*Phintella parva*: Prószyński, 1983b, p. 6.

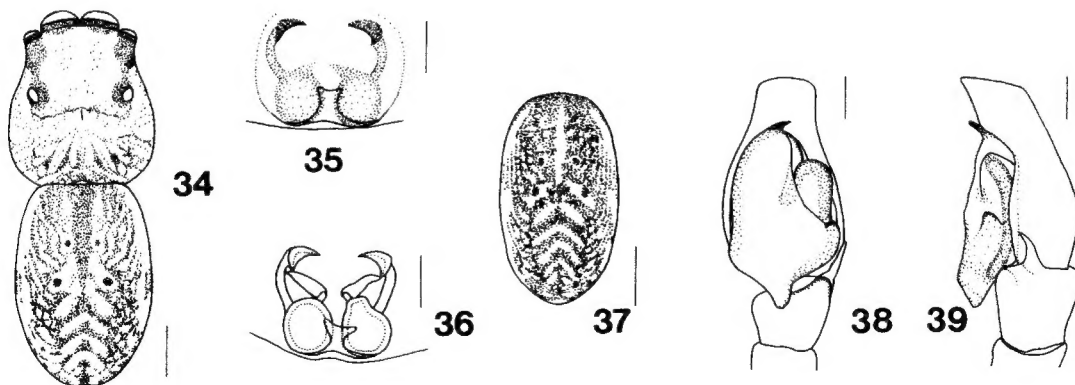
**Specimens examined.** 1 ♂, Kyöngsangbuk-do, P'algongsan, Tonghwasa, 28 May 1964, K. Y. Paik; 1 ♀, Kyöngsangbuk-do, P'algongsan, Tonghwasa, 19 Jun. 1977, Y. M. Shin; 1 ♀, Kyöngsangbuk-do, Ch'öngsong, Top'yöng, 18 Jul. 1966, J. H. Kim; 1 ♀, Kyöngsangbuk-do, Söngju, Kayasan, 28 Aug. 1968, Y. Huh; 1 ♀, 1 ♂, Kyöngsangbuk-do, P'algongsan, P'agyesa, 20 May 1978, B. S. Jo; 1 ♀, Kyöngsangbuk-do, P'algongsan, P'agyesa, 23 Jul. 1985, J. M. Park; 1 ♀, 1 ♂, Kyöngsangbuk-do, P'algongsan, 17 May, 30 Jul. 1985, M. H. Lee; 1 ♀, Kyöngsangbuk-do, P'algongsan, Pukjijangsa, 6 Aug. 1993, D. H. Kim; 1 ♀, Ch'ungchöngbuk-do, Sobaeksan, 5 Jun. 1994, H. C. Kim.

**Description.** Carapace yellow with indistinct radial black markings posteriorly. Leg formula 4312 in both sexes. Dorsum of abdomen yellow with two longitudinal indistinct black stripes, one on either side, running its full length, and a black median stripe continuing the anterior to second sigilla; occasionally without a median stripe; four to five intact chevrons posteriorly, but first one sometimes interrupted; distal part with an indistinct longish black stripe. Venter of abdomen with a black median stripe from epigastric furrow to spiracle and a transverse black line on each side in front of spinnerets.

**Distribution.** Korea, China, USSR.

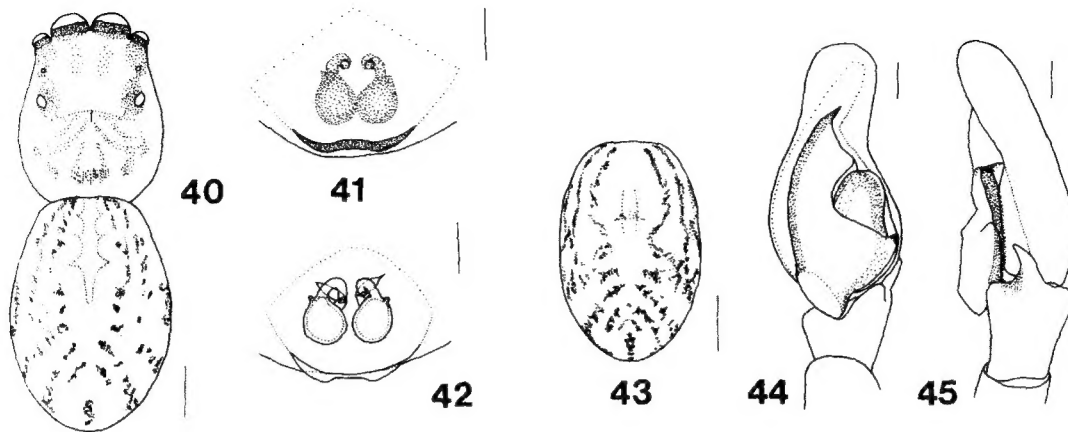
***Phintella popovi* (Prószyński, 1979) (Figs. 40-45)**

*Icius popovi* Prószyński, 1979, p. 311, figs. 150-153.



**Figs. 34-39.** *Phintella parva*: 34, female, dorsal view; 35, epigynum of female; 36, internal genitalia of female; 37, male abdomen, dorsal view; 38, male papal organ, ventral view; 39, ditto, retrolateral view. Scale lines: 0.5 mm (figs. 34, 37), 0.1 mm (figs. 35-36, 38-39).





**Figs. 40-45.** *Phintella popovi*: 40, female, dorsal view; 41, epigynum of female; 42, internal genitalia of female; 43, male abdomen, dorsal view; 44, male palpal organ, ventral view; 45, ditto, retrolateral view. Scale lines: 0.5 mm (figs. 40, 43), 0.1 mm (figs. 41-42, 44-45).

*Icius linea*: Wesolowska, 1981a, p. 57, figs. 37-38 (part: ♀).

*Phintella popovi*: Prószyński, 1983b, p. 7.

**Specimens examined.** 1 ♀, Taegu, 10 Jul. 1956, G. Y. Lee; 3 ♀ ♀, Taegu, ? Aug. 1966, K. Y. Paik; 6 ♀ ♀, 2 ♂ ♂, Kyöngsangbuk-do, Talsöng, Kach'ang, 17 May 1958, H. J. Lee and K. Y. Paik; 1 ♀, Kyöngsangbuk-do, P'algongsan, Tonghwasan, 28 May 1964, K. Y. Paik; 4 ♀ ♀, Kyöngsangbuk-do, Ch'öngsong, Top'yöng, 18 Jul. 1966, J. H. Kim; 3 ♂ ♂, Pusan, Kümjöngsan, 21-27 Apr. 1975, J. H. Kim; 3 ♀ ♀, Kyöngsangbuk-do, Pisälsan, 24 Apr. 1978, G. J. Kim; 1 ♂, Kyöngsangbuk-do, Kumi, Kümösan, 29 May 1994, M. W. Kim.

**Description.** Carapace yellowish brown with an intermittent concave black stripe. Thoracic fovea with black markings radiating backward. Leg formula 4312 in female, 1432 in male. Dorsum of abdomen yellowish brown with two longitudinal black dotted lines or a longitudinal black broad stripe on each side, continuing from the anterior to first chevron; two interrupted large chevrons, one to two small ones that are interrupted or not, and a longish black stripe at the end. Venter of abdomen yellowish brown with a transverse black line on each side in front of spinnerets.

**Distribution.** Korea, China, USSR.

**Note.** This species is recorded for the first time in Korean spider fauna.

### Multivariate Analyses

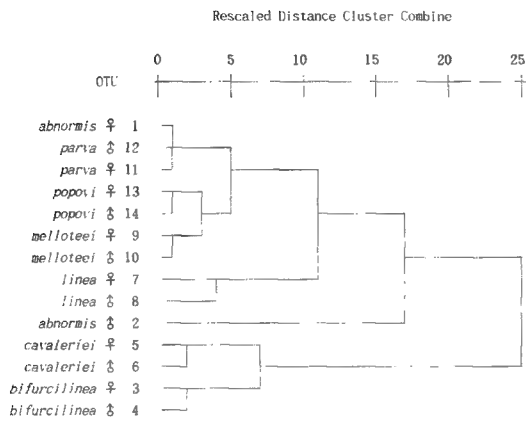
STDs of 32 RVCs ranges over from 0.01 to 0.34 (Table 1). The result of cluster analysis was nearly random except the cases of STD 0.04 and 0.05 showing the best result, and especially the cases above STD 0.16 tend to agglomerate to male and female groups. Fig. 46 shows the result of cluster analysis performed with the case of STD 0.05 including a little more RVCs. The result is well constructed the same as the author's pairing ones except OTU 1 and 2. And the cluster, excluded OTU 1 and 2, exhibited the perfect pairing in Fig. 47. Accordingly, the reason of unpairing of OTU 1 and 2 was considered to have shown that sexual dimorphism of OTU 1 and 2, female and male of *P. abnormis*, is more distinct than the others, that is, they have larger dissimilarity than the pairs of

**Table 1.** Means of each character of 7 species belonging to Genus *Phintella* and STDs of 134 individuals.

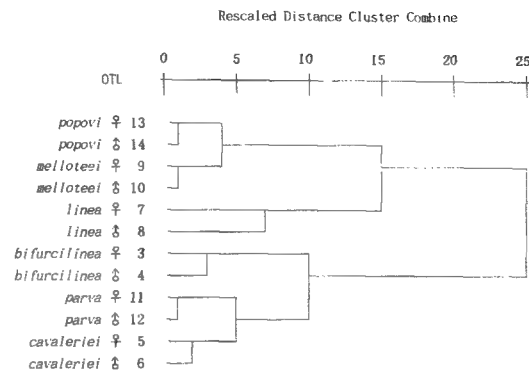
Species	<i>abnormis</i>		<i>bifurcilinea</i>		<i>cavaleriei</i>		<i>linea</i>		<i>melloteei</i>		<i>parva</i>		<i>popovi</i>		
OTUs	♀(11)	♂(9)	♀(12)	♂(7)	♀(15)	♂(7)	♀(11)	♂(5)	♀(12)	♂(10)	♀(9)	♂(2)	♀(18)	♂(6)	STD
Characters	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
CAL	1.93	2.18	1.49	1.49	1.72	1.73	1.74	1.81	1.76	1.62	1.78	1.55	1.83	1.85	0.09
CAW	1.40	1.66	1.03	1.07	1.22	1.23	1.28	1.39	1.24	1.20	1.24	1.11	1.28	1.31	0.08
ER1	1.20	1.28	0.98	1.01	1.17	1.14	1.12	1.16	1.06	1.01	1.10	0.97	1.11	1.13	0.00
ER2	1.05	1.10	0.84	0.85	1.01	0.98	1.02	1.04	0.95	0.91	0.96	0.85	0.98	1.00	0.03
ER3	1.16	1.19	0.96	0.96	1.11	1.08	1.15	1.15	1.05	1.00	1.07	0.94	1.09	1.06	0.03
FE1	1.14	2.44	0.77	0.95	0.97	1.05	0.89	1.21	0.92	1.15	0.94	0.99	1.01	1.28	0.28
P1	0.59	1.08	0.39	0.47	0.52	0.55	0.52	0.69	0.53	0.63	0.52	0.53	0.57	0.72	0.12
T1	0.82	2.38	0.52	0.82	0.69	0.79	0.59	0.95	0.62	0.87	0.65	0.82	0.71	1.09	0.34
M1	0.71	2.07	0.47	0.74	0.59	0.68	0.52	0.78	0.52	0.75	0.57	0.69	0.62	0.87	0.29
TA1	0.46	0.91	0.32	0.41	0.39	0.42	0.40	0.42	0.38	0.46	0.39	0.42	0.42	0.49	0.10
FE2	1.10	1.89	0.69	0.83	0.92	0.96	0.83	1.04	0.86	0.98	0.89	0.91	0.96	1.07	0.18
P2	0.54	0.77	0.35	0.39	0.46	0.47	0.47	0.56	0.47	0.0	0.57	0.45	0.52	0.54	0.06
T2	0.74	1.57	0.44	0.61	0.59	0.65	0.52	0.71	0.55	0.72	0.57	0.67	0.62	0.78	0.19
M2	0.71	1.54	0.45	0.61	0.58	0.63	0.49	0.72	0.53	0.70	0.55	0.68	0.59	0.75	0.19
TA2	0.43	0.66	0.28	0.37	0.36	0.39	0.36	0.37	0.37	0.42	0.38	0.42	0.39	0.44	0.00
FE3	1.26	1.88	0.84	0.91	1.09	1.12	0.95	1.10	1.00	1.08	1.03	1.01	1.11	1.18	0.16
P3	0.55	0.68	0.37	0.38	0.48	0.48	0.49	0.51	0.47	0.46	0.49	0.44	0.52	0.54	0.05
T3	0.83	1.48	0.51	0.67	0.69	0.73	0.55	0.68	0.66	0.79	0.67	0.72	0.70	0.81	0.16
M3	1.03	1.77	0.69	0.86	0.90	0.93	0.75	0.89	0.79	0.92	0.82	0.92	0.89	1.00	0.17
TA3	0.51	0.66	0.36	0.39	0.44	0.45	0.42	0.39	0.45	0.49	0.45	0.44	0.46	0.48	0.06
FE4	1.44	2.01	1.05	1.10	1.23	1.26	1.11	1.21	1.13	1.17	1.21	1.15	1.28	1.31	0.14
P4	0.55	0.67	0.39	0.37	0.48	0.48	0.49	0.49	0.49	0.47	0.49	0.43	0.53	0.54	0.04
T4	1.05	1.69	0.73	0.80	0.89	0.94	0.72	0.82	0.85	0.97	0.90	0.88	0.94	1.00	0.17
M4	1.23	1.92	0.81	0.94	1.07	1.10	0.91	1.00	0.95	0.99	1.01	1.03	1.10	1.09	0.17
TA4	0.51	1.69	0.73	0.80	0.89	0.94	0.72	0.82	0.85	0.97	0.90	0.88	0.94	1.00	0.17
F1D	0.36	0.39	0.26	0.27	0.31	0.31	0.35	0.45	0.34	0.36	0.32	0.28	0.36	0.38	0.04
A	0.58	0.59	0.47	0.50	0.55	0.53	0.51	0.56	0.51	0.50	0.50	0.46	0.51	0.51	0.03
B	1.00	1.06	0.85	0.86	0.93	0.92	0.89	0.97	0.88	0.85	0.89	0.81	0.90	0.92	0.04
C	0.38	0.42	0.32	0.33	0.36	0.35	0.34	0.36	0.33	0.32	0.34	0.32	0.34	0.34	0.02
D	0.19	0.21	0.18	0.19	0.20	0.19	0.17	0.20	0.17	0.17	0.18	0.17	0.18	0.18	0.01
E	0.04	0.05	0.04	0.04	0.04	0.04	0.04	0.05	0.04	0.06	0.04	0.04	0.04	0.05	0.01
F	0.19	0.20	0.17	0.18	0.18	0.18	0.16	0.19	0.18	0.17	0.17	0.16	0.17	0.18	0.01
G	0.88	0.87	0.68	0.69	0.83	0.81	0.90	0.88	0.79	0.75	0.81	0.69	0.81	0.83	0.04

\*Numerals in parentheses are the number of individuals used in measurements

the others (Table 3). In spite of these results, pairing of 7 species was possible because one species only failed in pairing.



**Fig. 46.** Dendrogram of 14 OTUs obtained from Cluster Analysis using Ward Method



**Fig. 47.** Dendrogram of 12 OTUs obtained from Cluster Analysis using Ward Method.

**Table 2.** Mean ratio values of 14 OTUs for 13 RVCs

	er2	er3	p3	p4	ta4	f1d	a	b	c	d	e	f	g
1	.8712	.9645	.4557	.4607	.4230	.2999	.4799	.8364	.3178	.1611	.0372	.1548	.7289
2	.8581	.9267	.5303	.5172	.5309	.3012	.4579	.8297	.3272	.1608	.0425	.1583	.6824
3	.8607	.9838	.3767	.3967	.3819	.2627	.4745	.8642	.3263	.1794	.0435	.1759	.6978
4	.8378	.9459	.3786	.3695	.4117	.2661	.4901	.8449	.3249	.1834	.0422	.1740	.6817
5	.8659	.9514	.4079	.4127	.3861	.2654	.4690	.8001	.3109	.1730	.0366	.1570	.7112
6	.8501	.9250	.4247	.4273	.4276	.2612	.4622	.7994	.3141	.1792	.0439	.1636	.6780
7	.9086	1.0294	.4338	.4373	.3669	.3166	.4588	.7993	.3008	.1504	.0398	.1456	.8012
8	.8931	.9958	.4388	.4165	.3572	.3838	.4864	.8385	.3130	.1691	.0404	.1619	.7568
9	.8917	.9902	.4381	.4635	.4312	.3221	.4761	.8248	.3072	.1603	.0401	.1656	.7420
10	.9049	.9869	.4567	.4676	.4619	.3546	.4933	.8401	.3166	.1689	.0553	.1647	.7397
11	.8718	.9702	.4411	.4408	.4126	.2940	.4574	.8120	.3070	.1612	.0387	.1550	.7336
12	.8790	.9669	.4505	.4396	.4068	.2855	.4725	.8353	.3297	.1758	.0440	.1650	.7143
13	.8833	.9734	.4635	.4794	.4259	.3243	.4546	.8096	.3094	.1657	.0384	.1554	.7267
14	.8866	.9394	.4766	.4730	.4385	.3340	.4515	.8137	.3010	.1564	.0415	.1638	.7329

Canonical discriminant functions 1, 2 and 3 used in discriminant analysis have 35.62, 32.34 and 17.92 percent of variance respectively. The functions evaluated at OTU means were shown in Table 4, and plottings of group centroid of each OTU to the functions were shown in Fig. 48. These results are not satisfactory.

Fig. 49 is the result of cluster analysis carried out with mean ratio values of 26 characters of both sexes. It's similar to the pairing clusters.

**Table 3.** Squared Euclidean Dissimilarity Coefficient Matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13
2	.0248												
3	.0166	.0674											
4	.0203	.0631	.0045										
5	.0093	.0511	.0073	.0081									
6	.0103	.0331	.0139	.0094	.0045								
7	.0176	.0719	.0300	.0440	.0211	.0378							
8	.0160	.0682	.0255	.0344	.0224	.0356	.0115						
9	.0025	.0313	.0195	.0259	.0128	.0166	.0117	.0122					
10	.0070	.0263	.0314	.0362	.0253	.0261	.0216	.0156	.0035				
11	.0020	.0333	.0138	.0175	.0047	.0080	.0125	.0151	.0032	.0111			
12	.0018	.0316	.0103	.0143	.0055	.0074	.0185	.0162	.0050	.0112	.0023		
13	.0027	.0230	.0259	.0311	.0140	.0145	.0161	.0162	.0024	.0061	.0033	.0055	
14	.0046	.0190	.0324	.0346	.0178	.0158	.0224	.0196	.0052	.0071	.0059	.0084	.0019

\*This matrix was made out from the data of table 2.

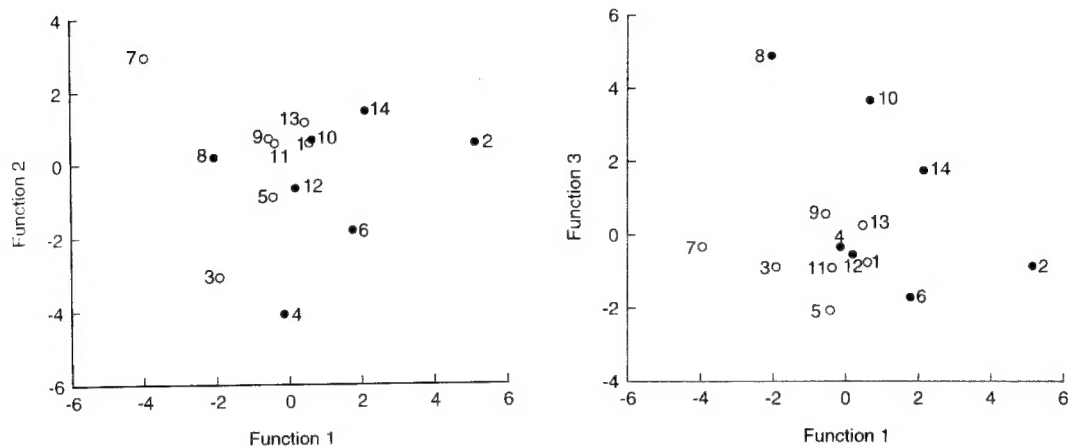
**Table 4.** Canonical Discriminant Function evaluated at OTU means (group centroid).

OTU	Function 1	Function 2	Function 3	OTU	Function 1	Function 2	Function 3
1	0.59100	0.56321	-0.73790	8	-2.03828	0.18716	4.90238
2	5.15372	0.54620	-0.83957	9	-0.53530	0.69359	0.57080
3	-1.91245	-3.08369	-0.87104	10	0.66416	0.65300	3.69847
4	-0.14599	-4.08352	-0.32622	11	-0.36789	0.56267	-0.89435
5	-0.41875	-0.90806	-2.05831	12	0.19395	-0.67013	-0.53196
6	1.77416	-1.81568	-1.69866	13	0.46728	1.13470	0.27043
7	-3.94641	2.93026	-0.32097	14	2.14081	1.43973	1.76736

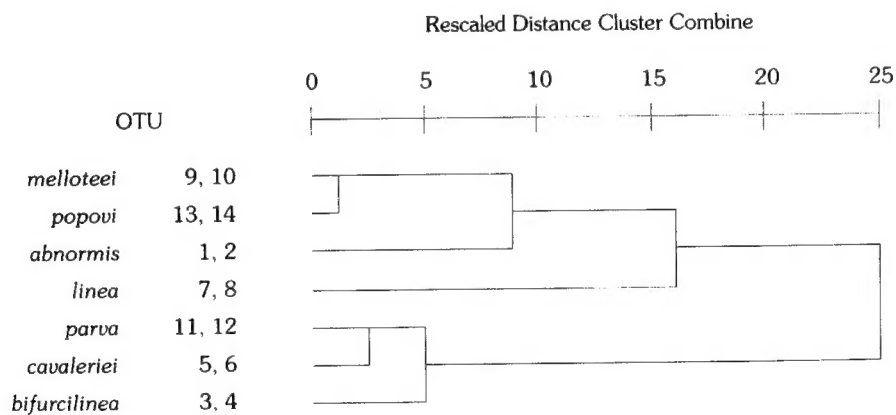
## DISCUSSION

Redescriptions, illustrations and an identification key of 7 species of genus *Phintella*, including *P. popovi* newly recorded in Korean spider fauna, are considered to be helpful to subsequent identifications of this genus from Korea.

7 RVCs (er2, er3, a, c, d, e and f) below STD 0.03 among 13 RVCs selected for the pairing test are likely to be rather even in this genus. According to the preliminary test performed with 22 individuals of 11 species in 11 genera, 4 RVCs below STD 0.02 (c, d, e and f) among the 7 RVCs seem to be rather even in family Salticidae. The pairs in the cluster were the same as the case of 13 RVCs even if one excludes 4 RVCs, c, d, e and f, from 13 RVCs below STD 0.05. Hence 9 RVCs



**Fig. 48.** Plottings of centroid of each OTU to functions obtained from Discriminant Analysis. Open and closed circles indicate females and males respectively.



**Fig. 49.** Dendrogram of 7 species belonging to genus *Phintella* obtained from Cluster Analysis using Ward Method.

(er2, er3, p3, p4, ta4, f1d, a, b and g) would be essential for the pairing test simultaneously revealing the differences of sexual dimorphism and species.

Though the pairing of 7 species was possible, it will be necessary to find out more essential characters for the improvement of this method.

The results by the discriminant analysis shown in Fig. 48 are not likely to be adequate for the pairing test for the present.

It's noticeable that *P. mellotei* and *P. popovi* in the cluster of Fig. 49 showed the nearest relationship among 3 species, *P. linea*, *P. mellotei* and *P. popovi*, which are frequently easy to be misidentified because of their similar abdominal patterns.

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한국산 *Phintella*속(거미목, 깡충거미과)의 재기재와 다변량분석

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## 요 약

한국산 *Phintella*속에 속하는 6종의 기재와 동정은 불충분하고 불확실한 상태에 있다. 본 논문에서는 한국미기록종인 *P. popovi*를 포함한 7종에 대하여 그림, 검색표와 함께 재기재를 하였고, Wesolowska(1981a)에 의하여 한국산으로 보고된 바 있는 *Icius munitus*를 *P. cavaleriei*로 synonym처리를 하였다. 또, 본인의 동정과 짝짓기를 검정하기 위하여, 134개체에 대한 표준편차 0.05 이하의 13개 형질비값으로 다변량분석을 실시하였다. 134개체에 대한 13개의 형질비값으로 시행된 판별분석의 결과는 만족스럽지 못하였으나, 13개의 형질비값에 대한 14개 OTU의 평균비값으로 시행된 군집분석의 결과는 다른 쌍들에 비하여 비유사성이 큰 *P. abnormis*를 제외하고 저자의 짝짓기 결과와 일치함을 보여 주었다. 완벽한 결과를 보여 주지는 못하였으나, 단 한 종만 짝을 만들지 못하였기 때문에 전체 7종의 쌍을 얻을 수는 있었다. 이 방법이 보다 개선되면, 올바른 짝을 검정하거나 동정할 때 유용하게 사용될수 있을 것으로 생각된다.